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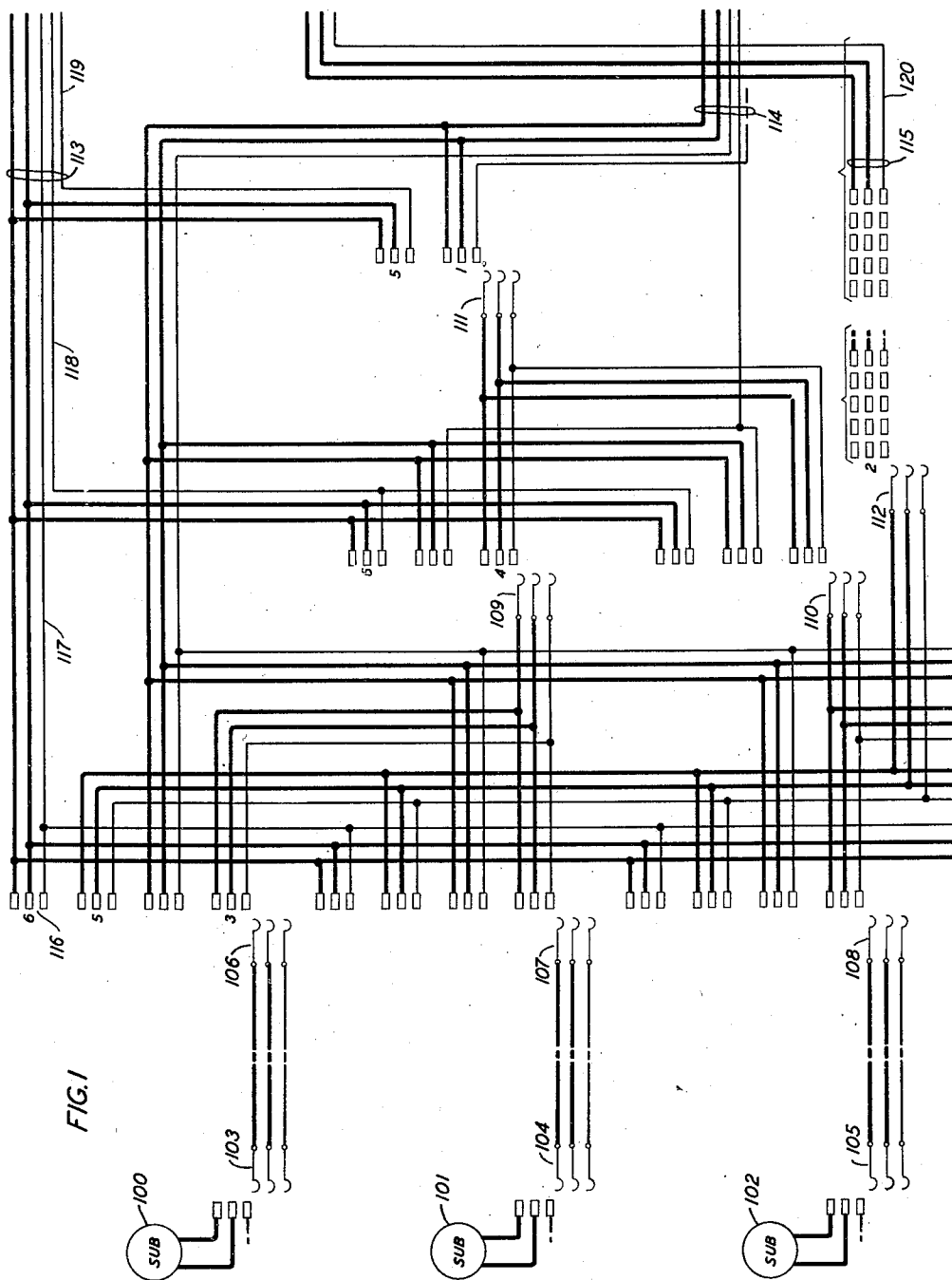
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2,369,062

AUTOMATIC TOLL TICKETING SYSTEM

Filed June 27, 1942

4 Sheets-Sheet 1



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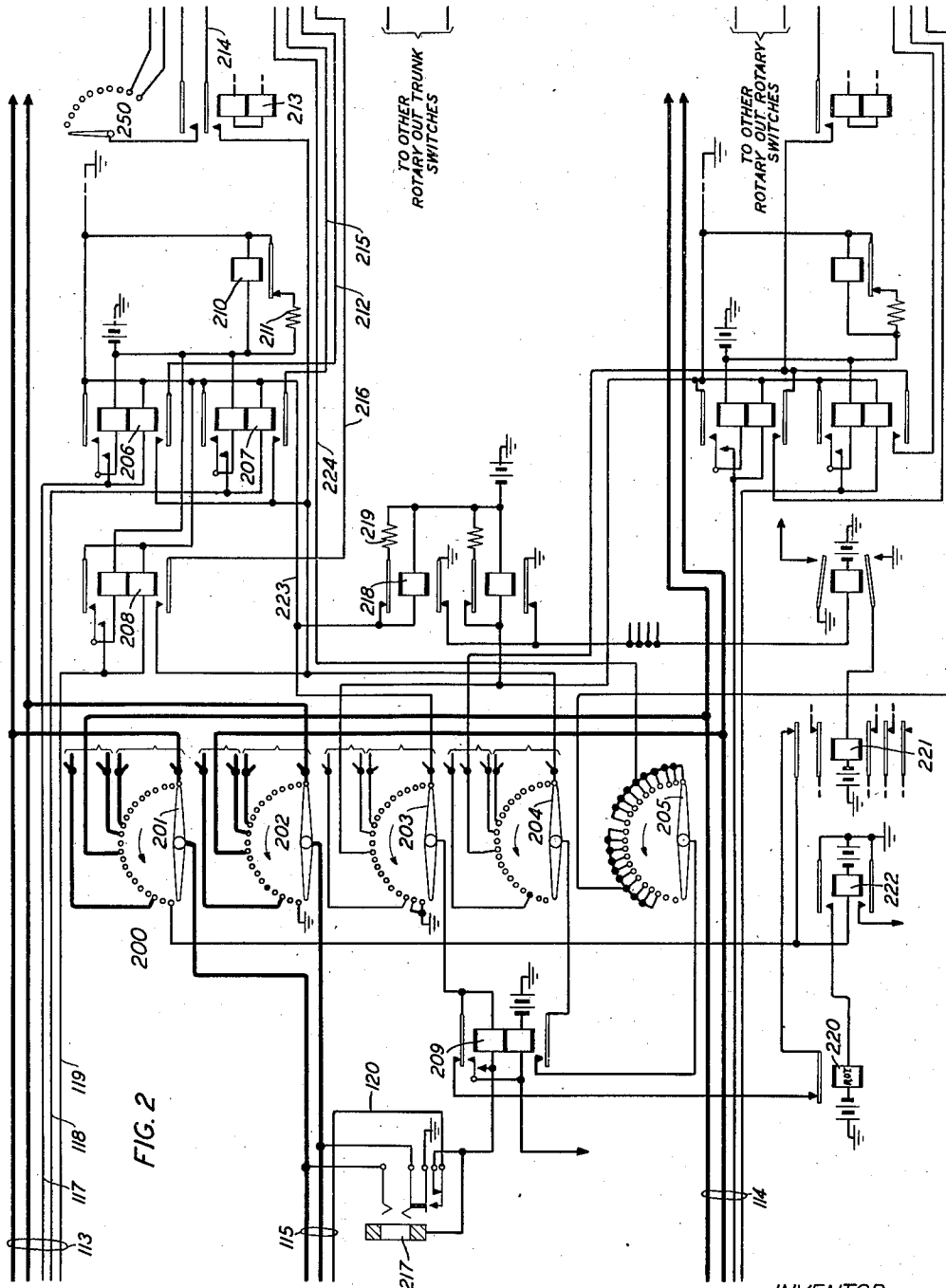
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4 Sheets-Sheet 2



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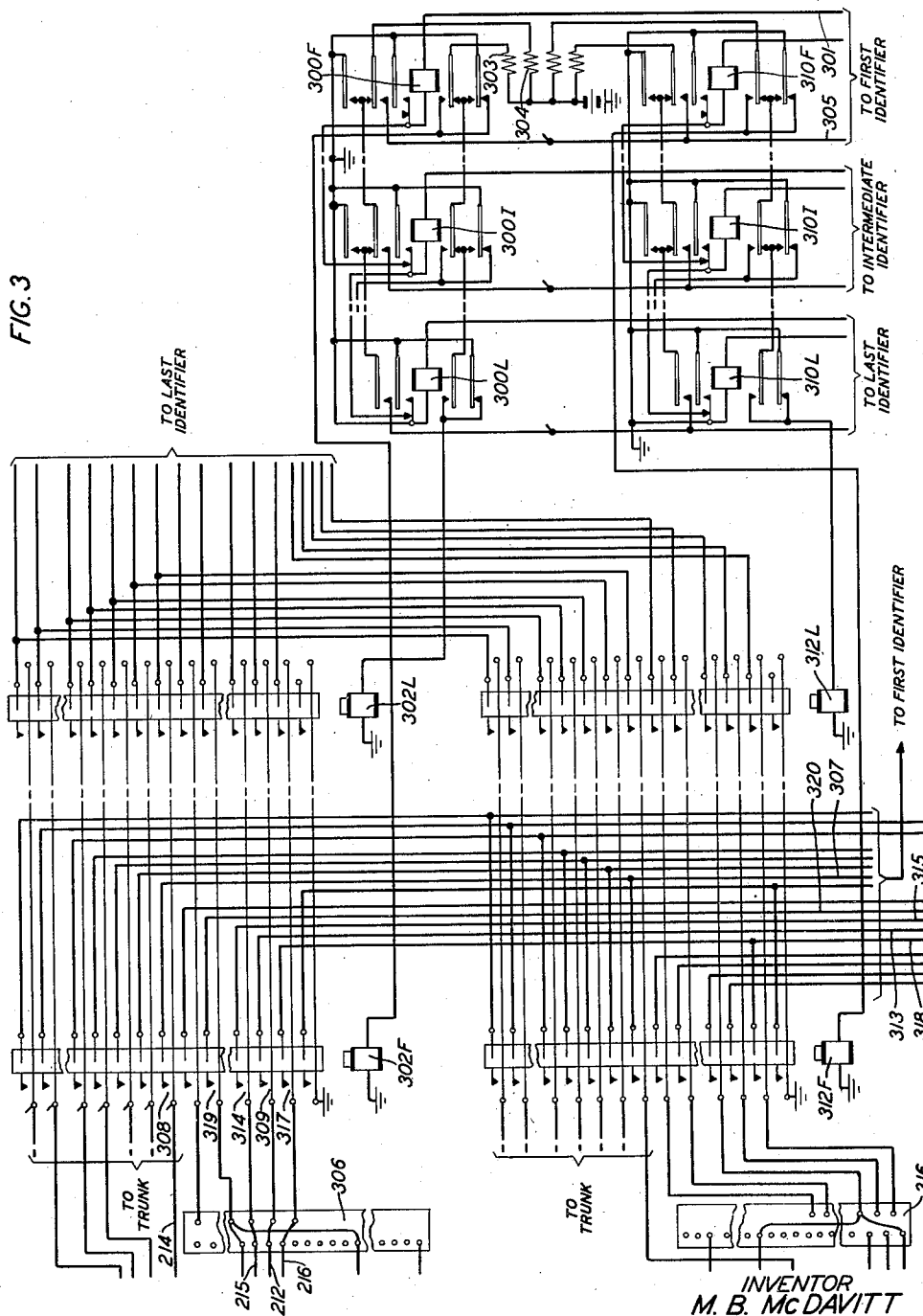
2,369,062

AUTOMATIC TOLL TICKETING SYSTEM

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4 Sheets-Sheet 3

FIG. 3



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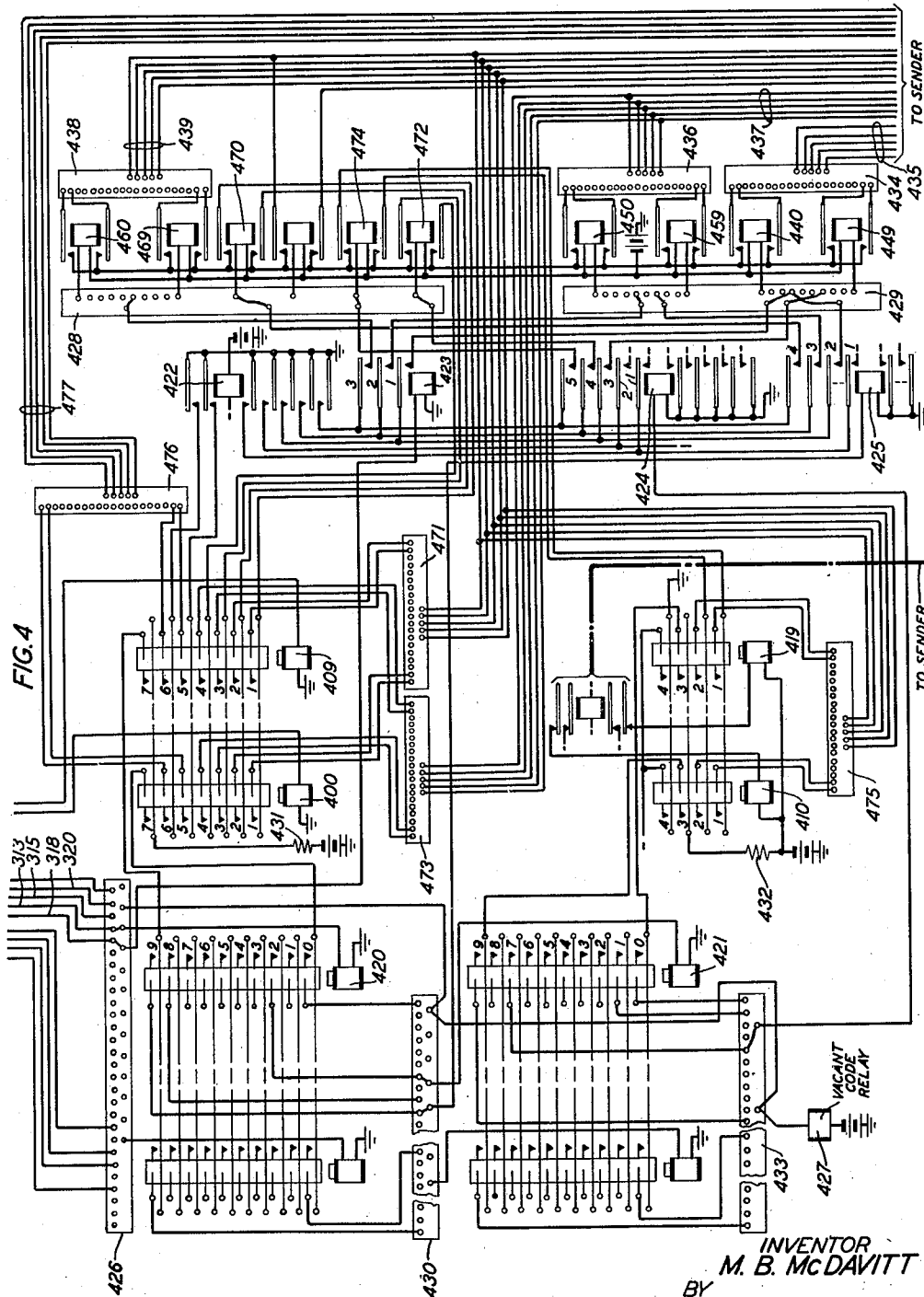
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AUTOMATIC TOLL TICKETING SYSTEM

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,369,062

AUTOMATIC TOLL TICKETING SYSTEM

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Application June 27, 1942, Serial No. 448,789

6 Claims. (Cl. 179—9)

This invention relates to a telephone system and more particularly to a system in which connections are established to certain offices over a tandem trunk by selecting the trunk in response to the dialing of one or more of the office code digits of a wanted line designation and in which it is necessary to secure a record of the office code digits dialed for controlling the further extension of a connection from the trunk to the office in which the desired line terminates or for other purposes.

In telephone systems of the type in which selector switches are controlled by a register sender common to all lines of an originating office in which both the office code digits and numerical digits of wanted lines are registered in response to dialing by the calling subscriber, it is well-known practice when the wanted line terminates in a distant office to provide intermediate or tandem offices through which such calls are extended to such distant offices. Such a tandem office is provided with trunks incoming from originating offices which terminate in selector switches having access to trunks outgoing to such distant offices and with tandem senders accessible from the tandem trunks which are capable of controlling selector switches to extend a connection from a tandem trunk to a desired distant office and for setting selector switches in the selected distant office to complete the connection. The tandem trunk is selected by the setting of selector switches in response to the registration of the office code digits of a wanted line which terminates in the distant office whereupon the tandem trunk seizes an idle tandem sender and the originating sender transfers all of its digit registrations including the office code and numerical digit registrations of the wanted line number to registers of the tandem sender. The tandem sender then proceeds to control selector switches to extend a connection from the tandem trunk to the office of the wanted line in accordance with the office code digit registrations transferred thereto from the originating sender and to control selector switches in the selected office in accordance with the numerical digit registrations transferred thereto from the originating sender.

When, however, it becomes desirable to provide tandem office equipment of the type above described in telephone systems which have no common senders in the originating offices and in which the selector switches are of the type which are controlled in their selective movements directly under the control of the calling subscriber's dial, it becomes necessary when a tandem trunk is selected by the setting of such selector switches in response to the dialing of the office code digits of a wanted line terminating in a distant office to be reached over the tandem trunk, to provide means for ascertain-

ing the office code digits which have been dialed so that a sender may register such digits for use in further extending the connection from the tandem trunk to such wanted office.

A specific application of tandem trunking of this character may be made, for example, in connection with the extension of short haul toll connections to offices in the nearby toll area in which the tandem trunks are provided with automatic toll ticket printing facilities whereby all such short haul toll connections may be established automatically under the control of a calling subscriber's dial and the toll ticket may be automatically printed. A system of this type is disclosed in the copending application of J. W. Gooderham, Serial No. 448,782, filed June 27, 1942, concurrently herewith. Since for ticketing purposes the ticket printer must be supplied with the designations of both the calling and wanted line, it is further essential that the office code digits of the wanted line, dialed by a calling subscriber to select the tandem trunk, be made available for the use of the toll ticket printer.

It is therefore the object of the present invention to provide facilities at a tandem trunk and at the equipment associable therewith which may, in a simple and accurate manner ascertain any office code digits which a calling subscriber may have dialed in setting up a connection to the tandem trunk and which may, in conjunction with any code digit dialed subsequent to the seizure of the trunk make a record of the entire office code of a wanted line number.

As illustrated herein a subscriber desiring a connection to a line terminating in an office of a nearby toll area, first removes his receiver from the switchhook whereby an idle line finder, paired with a first selector, is started in search of the calling line and, as soon as the line is found, the usual dial tone is transmitted. Upon hearing the dial tone, the subscriber then proceeds to dial the office code and numerical digits of the wanted line number. In response to the dialing of one or more of the office code digits, the selectors of a switching train including the first selector are operated to extend a connection from the calling line to an idle tandem or automatic ticketing trunk accessible from such lines of the office in which the calling line terminates as are permitted to establish toll connections by dialing, over which trunk a connection may be further extended to the office in which the wanted line terminates.

Immediately following the seizure of the trunk an idle sender common to a plurality of such trunks is associated with the seized trunk over a trunk finder. Since a digit dialed by a calling subscriber might be lost during the time elapsing between the seizure of the trunk and the seizure of an idle sender, the trunk is provided with a

digit register for registering the digit dialed following the last code digit dialed to reach the trunk. The sender is provided with registers for registering the remaining digits of the called line number dialed by a calling subscriber. On calls to certain offices, the trunk may be seized by a first selector in response to the dialing of a first office code digit. On calls to other offices the trunk may be seized by a second selector in response to the dialing of two office code digits. On calls to still other offices the trunk may be seized by a third selector in response to the dialing of three office code digits. In other cases a trunk may be seized in response to the setting of a selector switch, a bank level of which is divided to serve two trunk groups, the selector having access to two groups of rotary out-trunk switches which in turn have access to two groups of ticketing trunks. Since a trunk may be seized in response to the dialing of one, two or three code digits, the trunk register may register either the second or third code digit or the thousands numerical digit.

As soon as a first digit has been registered in the sender, which digit may be either the third code digit, the thousands numerical digit or the hundreds numerical digit, an idle identifier is associated with the sender over an identifier-connector and the identifier is associated directly with the trunk over a trunk identifier-connector. Thereupon office code identifying equipment associated with the trunk and selectively operated in accordance with whether the trunk was seized over a first, second or third selector bank level, establishes a record in the identifier from which the office code digits dialed to reach the trunk may be reconstructed and if other code digits have been registered by the trunk register or by the first register of the sender, such registration or registrations are also transferred to the identifier whereby from all such data registered in the identifier, a route relay is operated which is instrumental in furnishing all of the information required by the sender and the ticketing equipment of the trunk concerning the called line and the manner in which the call from the calling line to the called line shall be ticketed.

The invention having been described in a general manner, reference may now be had to the following detailed description thereof taken in connection with the accompanying drawings, in which:

Fig. 1 shows schematically, calling lines, line finders and a train of first and second and third selector switches for extending a connection from calling lines to tandem automatic ticketing trunks, two of which are illustrated and a selector switch of the type having access over a divided bank level to two groups of outgoing trunks;

Fig. 2 shows a rotary out-trunk switch accessible from a trunk incoming from the divided bank level switch and having access to a group of twenty automatic ticketing trunks;

Fig. 3 shows trunk-identifier-connectors over which control conductors from groups of automatic ticketing trunks may be extended to that one of a plurality of identifiers which has been seized by a sender in response to the seizure of a ticketing trunk; and

Fig. 4 shows such portions of an identifier as are necessary to an understanding of the present invention.

For a full disclosure of the present invention, Fig. 2 should be placed to the right of Fig. 1;

Fig. 3 should be placed to the right of Fig. 2; and Fig. 4 should be placed beneath Fig. 3.

The line finders 103, 104 and 105, the first selectors 106, 107 and 108, the second selectors 109 and 110, and the third selector 111 may be of the well-known step-by-step type and the selectors may be controlled directly by a calling subscriber's dial to establish local connections or to establish a connection to an idle automatic ticketing trunk such as trunk 113 or 114 should the subscriber desire a connection to a subscriber's line which terminates in the toll area adjacent to the exchange area in which the calling line terminates. A trunk of this type is fully disclosed in the application of Gooderham hereinbefore referred to. The trunks 113 and 114 are disclosed as having bank level appearances in first, second and third selectors, and of course the same trunk may have appearances in more than one bank level of the same selector switch, whereby the trunk may be seized in response to the dialing of the first code digit of certain distant offices, in response to the dialing of the first and second code digits of other offices and in response to the dialing of the three code digits of still other offices. To simplify the disclosure but two groups of tandem trunks are shown available for serving connections to all offices in the toll area. In the commercial use of the invention, however, a plurality of groups of trunks would be required to handle the toll traffic, for example, 200 trunks divided into ten main subgroups of twenty trunks each with each such subgroup subdivided into other minor subgroups of ten trunks each. Some of the groups of trunks would be made available only from bank levels of first selectors, other groups would be made accessible only from bank levels of second selectors and still other groups would be made accessible only from bank levels of third selectors. Still other groups might have branches as disclosed accessible from bank levels of different selectors and from banks of one or more rotary out trunk switches. The trunking scheme may therefore be made quite flexible for accommodating the trunk groups in accordance with the density of the toll traffic to different portions of the toll area.

The selector switch 112 of Fig. 1 may be of the divided level step-by-step type disclosed for example in Patent No. 2,249,067, granted July 15, 1941, to P. W. Wadsworth, and have access over the same bank level thereof to two groups of trunks terminating in rotary out-trunk secondary switches. One such trunk is schematically shown as 115 terminating in the rotary out-trunk switch 200 of Fig. 2. The switch 200 is of the step-by-step type disclosed in Patent 1,472,465, granted October 30, 1923, to Forsberg et al. The switch 200 is disclosed as having access to branches of trunks of two of the minor subgroups including the trunks 113 and 114.

Each ticketing trunk is provided with a sleeve relay such as relays 206, 207, 208 and 209 connected into the sleeve conductors of each bank level appearance of a trunk in the banks of first, second, third and divided level switches which relays are instrumental in establishing code signaling circuits through the trunk-identifier-connectors to the identifier seized to handle the call to enable the dialed office code digit of a desired line to be reconstructed.

Two of the ten trunk-identifier-connector circuits required to connect any one of the 200 ticketing trunks to the identifier seized to serve a connection are disclosed in Fig. 3. Each con-

connector circuit serves 20 trunks and is provided with a multicontact relay for each identifier and with a lockout relay for each identifier.

The identifier is provided with a group of ten multicontact relays 400 to 409, which serve as a register to which an office code digit or the thousands digit dialed into the register 250 of the ticketing trunk may be transferred, a group of ten multicontact relays 410 to 419 which serve as a register to which an office code digit or thousands or hundreds numerical digit dialed into the first dial pulse receiving register of the sender may be transferred and a group of multicontact relays, such as relay 420, including a relay for each of eight possible first selector level appearances of ticketing trunks and a relay for each of the possible second selector level appearances of trunks which relays cooperate with the trunk code register relays 400 to 409 to make a translation of the first code digit dialed to set a first selector and a second code digit dialed to set the register of the trunk or to make a translation of the first and second code digits dialed to set first and second selectors and a third code digit dialed to set the register of the trunk. A further group of multicontact relays, including relay 421, is provided, which relays cooperate with the sender code register relays 410 to 419 to make a translation of the first two code digits as translated by one of the trunk translator relays, for example, relay 420 and a third code digit dialed into the sender and transferred to the sender code register relays 410 to 419. The identifier is also provided with a route relay, such as relays 423, 424 and 425, for each possible called office route and with additional relays controlled thereby to transfer office code digits and other information concerning the called line to the sender.

To more clearly set forth the novel features of the invention, it will be assumed that the calling subscriber whose substation is identified by the numeral 100, initiates a call for a toll connection to a subscriber's line terminating in an office of the toll area to which the calling subscriber is permitted access by dialing. Upon the removal of the receiver from the switchhook, an idle line finder, such as 103, is started in search of the calling line in a well-known manner. When the line finder has found the calling line, the usual dial tone is transmitted over the calling line to inform the subscriber that his line has been connected with a first selector 106, paired with the line finder 103 and that he may therefore commence dialing the digits of the wanted line number.

It will first be assumed that the calling subscriber desires a connection with a line whose directory number is MAR-1345 and that a ticketing trunk over which a connection to this office may be extended may be reached from the sixth bank level of the first selector 106. The calling subscriber upon hearing the dial tone therefore proceeds to dial the office code letters M, A, R, and the numerical digits 1, 3, 4, 5. In response to the dialing of the first office code letter M, which has a numerical equivalent 6, the first selector 106 is operated to elevate its brushes to a position opposite its sixth bank level and to then hunt over the terminals of this level in search of an idle ticketing trunk. It will be assumed that the trunk indicated by the numeral 113 is idle and that therefore when the test brush of the selector 106 engages test terminal 116 of this trunk, it will encounter no busy ground

potential thereon and therefore the selector switch will seize the trunk to extend a connection from the calling line to the tip and ring conductors of the trunk. As fully described in the Gooderham application hereinbefore referred to, the trunk proceeds to cause the operation of a trunk finder (not shown) to associate the trunk with an idle sender and to establish a circuit from ground at the selector 106 over the sleeve 117 of the trunk through the lower winding of sleeve relay 206, through the winding of relay 210 and in parallel therewith over the back contact of relay 210 and through resistance 209 to battery. Relay 206 operates from the low resistance battery thus supplied, prepares a locking circuit over its upper winding and uppermost front contacts to battery, short-circuits its lower winding and prepares a code signaling circuit to code lead 212 as will be later described. The trunk is now prepared to receive the second code letter A dialed by the subscriber which is registered as the digit 2 by the digit register 250 of the trunk in the manner fully described in the Gooderham application hereinbefore referred to.

By the time the second code letter dialed by the calling subscriber has been registered by the trunk register, a sender will have been associated with the trunk and the dialing circuit will upon the completion of the registration of the second code letter be extended over the brushes of the trunk finder to the sender. Therefore when the calling subscriber dials the third code letter R, which has a numerical value of 7, the first dial pulse receiving register of the sender is set to register the third code letter. As soon as a digit has been registered in the sender, an idle identifier for identifying the calling line is associated with the sender and the identifier is informed through the prior operation of the trunk finder in which main group of 100 trunks and in which 20-trunk subgroup of such main group the calling trunk is located.

It will be assumed that the first identifier has been taken for use and that therefore a circuit is established which may be traced in part over conductor 301, through the winding of lock-out relay 300F, allocated to the first identifier and to the trunk-identifier-connector circuit having access to the Nos. 0 and 9 subgroups of the main group of trunks in which the calling line is assumed to be located and over the inner upper normal contacts of similar lock-out relays allocated to other identifiers to ground. Relay 300F operates if the trunk-identifier-connector circuit is not at the time being used by another identifier on another call; locks over its upper inner alternate contacts to ground; establishes an operating circuit for the multicontact relay 302F from ground through the winding of such relay over the inner lower front contact of relay 300F, through resistance 303 to battery and establishes a circuit from battery through resistance 304 over its middle upper front contact, conductor 305 and thence over a circuit not disclosed but fully described in the Gooderham application hereinbefore referred to which extends over contacts of the identifier-connector and trunk finder to ground through the winding of relay 213 of the calling trunk. With multicontact relay 302F of the trunk-identifier-connector circuit and relay 213 of the trunk both operated, a plurality of control conductors are extended from the trunk to the identifier.

It is to be noted that to serve each main group of 100 trunks, five trunk-identifier-connector cir-

cuits, of which two are disclosed in Fig. 3 are provided, the connector circuit comprising the lock-out relays 300F to 300L and the multicontact relays 302F to 302L serving the Nos. 0 and 9 subgroups of trunks or 20 trunks, the connector circuit comprising the lock-out relays 310F to 310L and the multicontact relays 312F to 312L serving the Nos. 1 and 4 subgroups and the three other connector circuits (not shown) serving, respectively, subgroups 2 and 5, 3 and 6 and 7 and 8. A similar group of five connector circuits would serve the second main group of 100 trunks.

As previously stated a sleeve relay, such as 206, is provided for each selector level appearance of a trunk and the code leads such as 212 associated with any trunk are connected over the contacts of the sleeve relays of all appearances of the particular trunk involved which appearances may be at the bank levels of first, second or third selectors. Where the bank appearances are terminated in rotary out-trunk switches, such as the one shown in Fig. 2, the code leads are connected to the bank associated with brush 205 of such switch, over brush 205, over contacts of the sleeve relay, such as relay 209, of the appearance of the trunk in a level of the divided level selector, such as 112, and over brush 204 and a terminal of the bank associated therewith. There will thus be a number of code leads connected between the contacts of the sleeve relays and the cross-connecting rack 306 associated with the trunk-identifier-connector circuit serving the subgroup of 20 trunks in which such trunk is located, one lead for each route appearance of the ticketing trunks of the two subgroups served by the connector circuit. After the operation of relays 302F and 213 as previously described, battery applied from the identifier to conductor 307 is connected over contact 308 of relay 302F, conductor 214, contacts of relay 213, lower contacts of the operated sleeve relay in the case assumed relay 206, to one of the code leads, for example 212 terminating in the cross-connecting rack 306. The code leads are cross-connected over the rack 306 to conductors which may be connected by contacts of an operated connector relay such as 302F to code leads extending to a cross-connecting rack 426 in the identifier.

The number of code leads, such as 309, extending through the connector circuit to the identifier will depend upon the number of possible route appearances of the trunk at the banks of selectors. For example if eight of the levels of the first selectors were involved in ticketing traffic, there would be a maximum of eight code leads corresponding with the eight appearances at the first selectors. In a like manner the maximum of route appearances that might occur from the bank levels of the second selectors available for ticketing traffic would be eight times eight or sixty-four appearances or code leads if all two-digit codes were involved in outgoing ticketing traffic. The number of route appearances from the banks of third selectors is an indeterminate number depending upon the number of routes involved through the bank levels of the third selectors. The cross-connection racks 306 and 316 are associated with the trunk-identifier-connector circuits so that the code leads from the sleeve relays, such as lead 212, which are associated with the same route appearance can be connected together. The only code leads brought through the connector circuits are those required for separate routes. The code leads entering the identifier and terminating on the cross-connect-

ing rack 426 may be cross-connected to the windings of route relays, such as 423, or to a trunk translator relay such as 420 or to a vacant code relay 427.

As previously stated, the identifier is provided with a route relay, such as 423, 424 and 425 for each called office route, contacts of such route relays being associated with cross-connection racks 428 and 429 so as to convey to the sender all of the information relating to the setting up of the connection to the called office route involved. The route relay for a called office will, in some cases, be operated directly from the code lead over cross-connection at the rack 426. The route relay 423 is shown so connected. The route relay in other cases may require a combination of the information obtained from a code lead and the digit which has been dialed into the trunk before it can be operated. In such a case the winding of the route relay, as for example relay 425, is connected to a terminal on connecting rack 430 over which it may be cross-connected to a contact of one of the trunk code translator relays such as relay 420. In still other cases the route relay may require a combination of the information from a code lead, the digit dialed into the trunk and also the first digit dialed into the sender to determine its operation. For example, in case the trunk appearance is in the bank of a third selector, it is apparent that the route relay such as 423 may be operated directly from the code lead since the subscriber has dialed the entire three digits of the office code designation which will determine the route relay to be operated. When the trunk appearance is in the bank of a second selector and all the code digits are required to determine the route, then the code lead will be cross-connected at the rack 426 to the winding of a trunk translator relay such as 420. The operation of one of the relays of the trunk code register 400 to 409 in accordance with the setting of the digit registered in the trunk in response to the dialed third code letter, will cause the connection of battery to one of the conductors extending over the contacts of the operated translator relay and cross-connected over rack 430 to the winding of a route relay such as 425.

In case the trunk appearance is in the bank of a first selector and all three code digits are required to determine the route, then the code lead of the first selector appearance will be cross-connected over the rack 426 to the winding of a trunk code translator relay, such as relay 420, thereby causing its operation when battery is applied over such code lead and through the operation of one of the trunk code register relays 400 to 409, battery will be connected through resistance 431 to one of ten conductors multiplied before the contacts of the trunk code translator relays and connectable through the operation of one of such translator relays to a terminal of the cross-connecting rack 430, cross-connected to the winding of one of the sender code translator relays such as 421, thereby causing the operation of one of such translator relays. The sender code register relays 410 to 419 are operable over the identifier connector in accordance with the setting of the first dial impulse receiving register of the sender and the operation of one of these relays will connect battery through resistance 432 and over contacts of the operated relay of the sender code translator group, for example relay 421, and terminals of the cross-connecting

rack 433 to the proper route relay, for example, 424.

The functions of the route relay are as follows: To inform the sender whether the called office code has two or three digits; whether a repeater is required at the tandem point and whether the called office code should be prefixed by a one or two digit repeater code in setting up the connection to the wanted office; whether the sender relay should be added for those cases where either a six digit or a seven digit number may be dialed; to inform the sender as to the number of called office code digits to be sent out by the sender in setting up a call to the distant point, since the ticketing trunk may be a direct trunk or may terminate at a tandem office or at a partial tandem point; to send the three office code digits to the sender or to control the sending of those digits to the sender when they are registered in the trunk or sender; to inform the sender as to whether the first digit dialed into the sender is an office code digit, a thousands or a hundreds digit and directly or in conjunction with the calling office register relays of the identifier to inform the sender or the trunk or both, whether the ticketing of the call should be cancelled or whether the route should be denied or whether a code has been dialed for which there is no existing office. Since the present invention is not directly concerned with most of these functions of the route relay, only those functions of the route relay involved in reconstructing the calling office code for use by the sender will be described herein.

It has been assumed that the trunk 113 has been seized over a bank level of the first selector 106 in response to the dialing of the first code letter M, that the second code letter A was registered in the trunk register and that the third code letter R was registered by the first register of the sender. It will be assumed that in response to the operation of the sleeve relay 206 and relays 213 and 302F, the code lead 212 indicative of a first selector level bank appearance is extended over contacts 309 of 302F and code lead 313 to the cross-connecting rack 426 where it is cross-connected to the winding of trunk code translator relay 420, whereupon relay 420 becomes operated in response to the application of battery to conductor 307. Since the second code letter A dialed by the calling subscriber has a numerical value of 2, the digit register 250 of the trunk has been advanced to register the digit 2 and after the operation of relay 302F of the trunk-identifier-connector circuit, the setting of the register is transferred to the identifier and results in the operation of relay 402 (not shown) of the trunk code digit register comprising relays 400 to 409. Since the third code letter R dialed by calling subscriber has a numerical value of 7, the first digit register of the sender has been set to register the digit 7 and such registration is transferred to the identifier and results in the operation of relay 417 (not shown) of the sender code digit register comprising relays 410 to 419.

With relays 402 and 420 operated and assuming that sender code translator relay 421 is cross-connected on the rack 430 for operation in response thereto, the circuit for relay 421 may be traced from battery, through resistance 431 over the No. 7 contacts of relay 402, over the No. 2 contacts of the translator relay 420, the strapped terminals of rack 430 to ground through the winding of translator relay 421. With relays 417

and 421 operated and assuming that route relay 424 is cross-connected on the rack 433 for operation in response thereto, the circuit for route relay 424 may be traced from battery through resistance 432 over the No. 3 contacts of relay 417 (not shown), over the No. 7 contacts of the operated translator relay 421 and the strapped terminals of rack 433 to ground through the winding of route relay 424. Relay 424 is thereupon operated.

It will now be assumed that the subscriber at substation 100 dialed the office designation DOW whereby an idle ticketing trunk is reached from a bank level of a second selector. In this case the first code letter D dialed results in the setting of the brushes of the first selector 106 to a position opposite the third level of its bank, whereupon the brushes rotate to select an idle second selector, for example, selector 109. The second code letter O dialed then results in the setting of the brushes of the second selector 109 to a position opposite the sixth level of its bank whereupon they rotate to select an idle ticketing trunk. It will be assumed that the trunk 113 is thus selected. In response to the dialing of the third code letter W, the register 250 of such trunk is set to register a digit value 9. With the trunk seized over a second selector bank terminal, a circuit is established over sleeve conductor 118 for sleeve relay 207 and in the manner previously described, an idle sender and identifier are seized and the identifier is associated with the calling trunk through the operation of trunk-identifier-connector relay 302F and trunk relay 213. When, thereafter, battery is connected at the identifier to conductor 307, a circuit is established over contacts 308 of relay 302F, conductor 214, contacts of relay 213, the lower contacts of sleeve relay 207, code lead 215, across strapped terminals on cross-connecting rack 306, contacts 314 of relay 302F and code lead 315 to a terminal of cross-connecting rack 426. This terminal is in this instance strapped to a terminal connected to the winding of an appropriate one of the trunk code translator relays, such as relay 420, and such translator relay is therefore operated. When thereafter the code digit 9 is transferred to the identifier, relay 409 of the trunk code digit register is operated. For convenience in illustration, it will be assumed that the translator relay 420 has been operated. Therefore upon the operation of relay 409, a circuit is established from battery through resistance 431, over the No. 7 contacts of relay 409, over the No. 9 contacts of relay 420 and thence over strapped terminals of the cross-connecting rack 430 to ground through the winding of route relay 425 which thereupon operates.

It will again be assumed that the subscriber at substation 100 dialed the office designation FIL whereby an idle ticketing trunk is reached from a bank level of a third selector. In this case the first code letter F dialed results in the setting of the brushes of the first selector 106 to a position opposite the third level of its bank whereupon they rotate to select an idle second selector, for example, selector 109. The second code letter I dialed then results in the setting of the brushes of the second selector 109 to a position opposite the fourth level of its bank, whereupon they rotate to select an idle third selector, for example, selector 111. The third code digit letter L dialed then results in the setting of the brushes of the third selector 111 opposite the fifth level of its bank, whereupon they rotate to

select an idle ticketing trunk. It will be assumed that the trunk 113 is thus selected and that the sleeve relay 208 thereof is operated over the sleeve conductor 119. In the manner previously described, an idle sender and identifier are seized and the identifier is associated with the calling trunk through the operation of trunk-identifier-connector relay 302F and trunk relay 213. When thereafter, battery is connected at the identifier to conductor 307, a circuit is established over contacts 308 of relay 302F, conductor 214, contacts of relay 213, the lower contacts of sleeve relay 208, code lead 216, across strapped terminals on cross-connecting rack 306, contacts 317 of relay 302F and code lead 318 to a terminal of cross-connecting rack 426. This terminal is in this instance strapped to a terminal directly connected to the winding of a route relay, for example, route relay 423, which relay is therefore operated.

As before stated, the ticketing trunk may in some cases become seized over the bank of a rotary out-trunk switch. It will now be assumed that the subscriber at substation 100 has dialed the office code KRA whereby an idle ticketing trunk is reached over a bank level of the selector 112 and over bank terminals of the out-trunk switch 200. In this case the first code letter K dialed results in the setting of the brushes of the first selector 106 to a position opposite the fifth level of its bank whereupon they rotate to select an idle selector 112 of the divided level type. The second code letter R dialed causes the brushes of selector 112 to be raised to the seventh level. It will be assumed that the switch is arranged to operate its shaft contacts when the brushes are raised to this level whereupon the switch shaft is released to its normal position. The second dialed code letter is therefore absorbed and a brush selection is made as fully disclosed in the Wadsworth patent hereinbefore referred to, whereby upon the dialing of the last code letter A, the brushes are raised to a position opposite the second bank level and are then rotated to select an idle trunk terminating in the second group of such bank level. It will be assumed that the trunk 115 is found to be idle and is therefore seized. Each of the trunks of this group terminates in a rotary out-trunk switch such as 200 of the type which normally stands upon the terminals of an idle outgoing or ticketing trunk. It will be assumed that the switch 200 and other similar switches are at the time standing on terminals allocated to the ticketing trunk 113.

When therefore the trunk 115 is seized by the switch 112, a circuit is established from ground at switch 112 over sleeve conductor 120 of trunk 115, over normal contacts of test jack 217 through the upper low resistance winding of sleeve relay 209, over brush 203 to battery through the winding of relay 218 and in parallel therewith over the upper back contact of relay 218 and through resistance 219 to battery. A circuit in parallel with the winding of relay 218 is also established over the upper back contact of relay 209, over the interrupter contacts of magnet 220, over back contacts of relay 221 to battery through the winding of stepping relay 222. Relay 209 operates but the winding of relay 222 being shunted by the winding of relay 218 and resistance 219 does not operate. The brushes of switch 200, therefore, remain in engagement with the terminals of trunk 113 and a dialing loop is extended from the calling line over the established connection including brushes 201

and 202 of switch 200, through the windings of the line relay (not shown) of trunk 113 to cause the association of a sender with the trunk and to connect ground to conductor 223 to mark the trunk as busy. With direct ground connected to conductor 223, relay 218 now operates if it has not previously operated, and sleeve relay 209 is held operated from ground on conductor 223, over brush 203, over the upper front contacts and through the lower winding of relay 209 to battery. This marking ground is also connected over sleeve conductor 120 to hold the line finder 103 and selector switches 106 and 112 in their operated positions.

With direct ground connected to conductor 223, a circuit is established over the brush 203 of other switches of the same group as switch 200 whose brushes may be in engagement with the terminals of the same trunk 113, thence over the upper back contact of the associated sleeve relay, corresponding to relay 209, over the interrupter contacts of the stepping magnet 220 of such switch, contacts of group relay 221, and to battery through the winding of the stepping relay 222 of such switch. Relay 222 thereupon operates in turn causing the operation of the associated stepping magnet 220 which, upon operating opens the circuit of relay 222. Relay 222 then releases in turn releasing magnet 220. Thus relay 222 and magnet 220 reciprocally control each other to cause magnet 220 to advance the switch brushes step-by-step until an idle outgoing trunk is encountered, at which time the brush 203 will find no busy ground and the switch brushes will be arrested in engagement with the terminals of such idle trunk. In this manner, all out-trunk switches whose brushes are engaged with the terminals of trunk 113 are advanced to preselect other idle ticketing trunks.

Following the seizure of an idle sender and the association of an idle identifier therewith, the trunk-identifier-connector relay 302F and the trunk relay 213 are operated and a circuit is established from battery connected at the identifier to conductor 307, over contacts 308 of relay 302F, conductor 214, contacts of relay 213, brush 204, the lower contacts of relay 209, brush 205, code lead 224, across strapped terminals of cross-connecting rack 306, contacts 319 of relay 302F and code conductor 320 to a terminal on cross-connecting rack 426. This terminal may be cross-connected directly to a terminal connected with the winding of a route relay since all three code letters of the office designation were dialed to reach the ticketing trunk.

The identifier is arranged to send the office code digits to the sender using five leads for each digit, two out of each group of five leads being grounded in each case. If all three code digits were dialed to reach the trunk as indicated for example by the operation of route relay 423 as previously described, the upper Nos. 1, 2 and 3 contacts thereof which are connected to terminals on cross-connecting racks 428 and 429 will be cross-connected to the windings of relays of the first code digit group 440 to 449, of the second code digit group 450 to 459 and of the third digit group 460 to 469 for operating relays of these groups corresponding to the three code digits dialed. Each of these relays is arranged upon its operation to connect ground to a pair of terminals in the associated cross-connecting rack. Rack 434 is associated with the relays of group 440 to 449 and has five terminals in which terminate the group 435 of five conductors over

which the first code digit is transmitted to the sender and to which terminals the other pairs of terminals of the rack are cross-connected in the proper combinations of two for the ten values of the first code digit. Rack 436 is associated with the relays of group 450 to 459 and has five terminals in which terminate the group 437 of five conductors over which the second code digit is transmitted to the sender and to which terminals the other pairs of terminals of the rack are cross-connected in the proper combinations of two for the ten values of the second code digit. Rack 438 is associated with the relays of group 460 to 469 and has five terminals in which terminate the group 439 of five conductors over which the third code digit is transmitted to the sender and to which terminals the other pairs of terminals of the rack are cross-connected in the proper combinations of two for the ten values of the third code digit. To reconstruct the dialed office code designation FIL, which resulted in the operation of route relay 423, the operation of such relay and relay 422 establishes a circuit over the No. 1 contacts thereof to battery through the winding of relay 443 (not shown) of the group 440 to 449 to cause the transmission of the first code digit 3 to the sender, a circuit over the No. 2 contacts thereof is established to battery through the winding of relay 454 (not shown) of the group 450 to 459 to cause the transmission of the second code digit 4 to the sender and a circuit over the No. 3 contacts thereof is established to battery through the winding of relay 465 (not shown) of the group 460 to 469 to cause the transmission of the third code digit 5 to the sender.

If the entire office code cannot be sent from the identifier to the sender by the route relay and the third code digit has been registered in the trunk and transferred to the trunk code register comprising relays 400 to 409, a route relay such as 425 will be operated as previously described and will cause the first code digit to be transmitted under its control through the operation of one of the relays of the group 440 to 449, the second code digit to be transmitted under its control through the operation of one of the relays of the group 450 to 459 and the third code digit to be transmitted under the control of one of the trunk code register relays of the group 400 to 409. In the case previously assumed, when the calling subscriber dialed the office designation DOW, the ticketing trunk was seized over a bank level of the second selector and the route relay 425 was operated. In this case upon the operation of relay 422, a circuit is established over the upper No. 2 contacts of relay 425 and over a strapping on cross-connection rack 429 through the winding of relay 443 (not shown) of the group 440 to 449 to battery to cause the transmission of the first code digit 3 to the sender, a circuit is established over the upper No. 3 contacts of relay 425 and over a strapping on cross-connecting rack 429 through the winding of relay 456 (not shown) of the group 450 to 459 to battery to cause the transmission of the second code digit 6 to the sender and a circuit is established over the upper No. 4 contacts of relay 425 over a strapping on cross-connection rack 428 to battery through the winding of relay 470. Relay 470 upon operating connects ground over its contacts and the Nos. 1 and 2 multiple contacts of the trunk code register relays 400 to 409, the cooperating contacts of which relays terminate in pairs of terminals on the cross-connecting rack

471 which are cross-connected to the proper combinations of two out of five terminals connected to the conductors of group 439 for the ten values of the third code digit. In the case assumed trunk code register relay 409 has been operated and consequently the digit 9 is transmitted to the sender as the third code digit.

In case the second code digit dialed was registered in the trunk and transferred to the trunk code register relays 400 to 409 and the third code digit dialed was registered in the sender and transferred to the sender code register relays 410 to 419 in the manner previously described as when the subscriber dialed the office designation MAR, the operated route relay, as for example, relay 424 would cause the transmission of the first code digit to the sender through the operation of one of the relays of the group 440 to 449 in the manner previously described, the second code digit would be transmitted under the control of the operated relay of the trunk code register group 400 to 409 and the third code digit would be transmitted under the control of the operated relay of the sender code register group 410 to 419. In the case assumed with route relay 424 operated, when relay 422 operates a circuit is established from ground over the upper No. 3 contacts of relay 424 over a strapping on cross-connection rack 429 through the winding of relay 446 (not shown) of the group 440 to 449 to battery to cause the transmission of the first code digit 6 to the sender and a circuit is established over the upper No. 4 contacts of relay 424 over a strapping on cross-connection rack 428 to battery through the winding of relay 472. Relay 472 upon operating connects ground over its contacts and the Nos. 3 and 4 multiple contacts of the trunk code register relays 400 to 409, the corresponding contacts of which relays terminate in pairs of terminals on the cross-connecting rack 473 which are cross-connected to the proper combinations of the conductors of group 437 for the ten values of the second code digit. In the case assumed trunk code register relay 402 (not shown) has been operated and consequently the digit 2 is transmitted to the sender as the second code digit. Relay 424 also establishes a circuit over its upper No. 5 contacts and over a strapping on cross-connection rack 428 to battery through the winding of relay 474. Relay 474 upon operating connects ground over its contacts and the Nos. 1 and 2 multiple contacts of the sender code register relays 410 to 419, the cooperating contacts of which relays terminate in pairs of terminals on the cross-connecting rack 475 which are cross-connected to the proper combinations of the conductors of group 439 for the ten values of the third code digit. In the case assumed sender code register relay 417 (not shown) has been operated and consequently the digit 7 is transmitted to the sender as the third code digit.

The identifier will always transfer the digit registered in the trunk code register comprising relays 400 to 409 to the sender since in some cases this digit may be the thousands digit as when the ticketing trunk has been seized from the third selector level, and the sender will thus require this digit in establishing the connection and in transmitting information to the ticket printer. Therefore when relay 422 operates, ground is connected over its upper contacts and the Nos. 5 and 6 multiple contacts of relays of the group 400 to 409, the cooperating contacts of which relays terminate in pairs of terminals on the cross-connecting rack 476 which are cross-

connected to the proper combinations of the conductors of group 477 for the ten values of the digit dialed into the trunk.

As previously stated, each route relay upon operating performs other functions fully described in the application of Gooderham hereinbefore referred to, but since the performance of such functions does not directly concern the present invention, the apparatus by which they are performed has not been disclosed nor described herein.

What is claimed is:

1. In a telephone system, a calling line, a train of selector switches, a trunk over which connections may be extended to any one of a plurality of offices having a plurality of branches accessible respectively from bank levels of different switches of said train in response to the dialing of one or more of the office code digits of a wanted line number, a relay individual to each branch of said trunk and operable upon the seizure of said trunk over said branch, means for registering all of the office code digits dialed in establishing a connection with any branch of said trunk, a plurality of circuits for controlling said registering means controlled respectively by said relays, and means operative following the seizure of said trunk to complete that one of said circuits which appertains to the branch over which said trunk was seized whereby the digits dialed to select said branch are registered by said registering means.

2. In a telephone system, a calling line, a train of selector switches, a trunk over which connections may be extended to any one of a plurality of offices having a plurality of branches accessible respectively from bank levels of different switches of said train in response to the dialing of one or more of the office code digits of a wanted line number, a relay individual to each branch of said trunk and operable upon the seizure of said trunk over said branch, means for registering all of the office code digits dialed in establishing a connection with any branch of said trunk, a plurality of circuits for controlling said registering means, each of said circuits including a relay indicative of a branch of said trunk, and means controlled by an operated one of said first relays to control the operation of the proper one of said latter relays whereby the digits dialed to select said trunk are registered by said registering means.

3. In a telephone system, a calling line, a train of selector switches, a plurality of trunks over each one of which connections may be extended to a plurality of offices and each of which has one or more branches accessible respectively from bank levels of different switches of said train in response to the dialing of one or more of the office code digits of a wanted line number, a relay individual to each branch of each of said trunks and operable upon the seizure of a trunk over that particular branch, means for registering all of the office code digits dialed in establishing a connection with any branch of any trunk, a plurality of circuits for controlling said registering means and selectively controlled by said relays, and means operative following the seizure of any one of said trunks to complete that one of said circuits which appertains to the branch over which said trunk was seized whereby the digits dialed to select said branch are registered by said registering means.

4. In a telephone system, a calling line, a train of selector switches, a plurality of trunks over

each one of which connections may be extended to a plurality of offices and each of which has one or more branches accessible respectively from bank levels of different switches of said train in response to the dialing of one or more of the office code digits of a wanted line number, a relay individual to each branch of each of said trunks and operable upon the seizure of a trunk over that particular branch, means for registering all of the office code digits dialed in establishing a connection with any branch of any trunk, a plurality of circuits for controlling said registering means each of said circuits including a relay indicative of a different called office route, and means operative upon the operation of one of said first relays to selectively complete a circuit including one of said latter relays whereby the digits dialed to select a trunk are registered by said registering means.

5. In a telephone system, a calling line, a train of selector switches, a plurality of primary trunks accessible respectively from the bank levels of selector switches of said train in response to the dialing of one or more of the office code digits of a wanted line number, each primary trunk terminating in a secondary trunk selecting switch, a plurality of outgoing trunks to which said secondary switches have common access over each one of which connections may be extended to a plurality of offices and idle one of which are normally preselected for seizure, a relay associated with each primary trunk and operable upon the seizure thereof, means for registering the office code digits dialed in establishing a connection with any one of said outgoing trunks, a plurality of circuits for controlling said registering means, each of said circuits including a relay indicative of a different called office route, and means controlled by the operation of one of said first relays to selectively complete a circuit including one of said latter relays whereby the digits dialed by a calling subscriber to select a primary and a preselected outgoing trunk are registered by said registering means.

6. In a telephone system, a calling line, a train of selector switches, a plurality of primary trunks accessible respectively from the bank levels of selector switches of said train in response to the dialing of one or more of the office code digits of a wanted line number, each primary trunk terminating in a secondary trunk selecting switch, a plurality of outgoing trunks to which said secondary switches have common access over each one of which connections may be extended to a plurality of offices and idle ones of which are normally preselected for seizure, a relay associated with each primary trunk and operable under the control of the outgoing trunk associated with such primary trunk, means for registering the office code digits dialed in establishing a connection with any one of said outgoing trunks, a plurality of circuits for controlling said registering means, each extending over contacts of one of said secondary switches and controlled by the relay associated with such secondary switch, each of said circuits being indicative of a different called office route, and means operative following the seizure of an outgoing trunk to complete that one of said circuits prepared by an operated relay whereby the office code digits dialed by a calling subscriber to select a primary trunk and a preselected outgoing trunk are registered by said registering means.

MARCELLUS B. McDAVITT.